

9) LAN:

Datalink Layer: addressing, 802.2

Ethernet/Fast Ethernet/Gigabit Ethernet: encapsulation, carrier sense multiple access collision detect (CSMA/CD), topology, speed, controller errors, limitations, 802.3

Token Ring: token passing, beaconing, Active Monitor, ring insertion, soft & hard errors, encapsulation, topology, maximum transmission unit (MTU), speed, limitations

FDDI/CDDI: dual ring, encapsulation, class, redundancy, dual homing, medium (copper, fiber), claims, Station Management (SMT), limitations

Fast Link Pulse – Fast Ethernet negotiation

FDDI

- 4b/5b encoding? All data to be transmitted is encoded prior to transmission using a **4 of 5 group code**. This means that for each 4 bits of data a corresponding 5 bit code word or symbol is generated by the encoder.
- Claim packet- if lower bid than station, packet is passed on by station. If higher bid, station forwards its own claim and bid.
- 2km on MMF between stations, 500 stations max, 200km max network diameter

Token ring bit A and bit C... A is for address recognized, and C is for frame copied. Initially 0 set to 1 once true.

What is Token Ring early release?

If early token release is supported, a new token can be released when frame transmission is complete.

What is beaconing?

A Token Ring algorithm called beaconing detects and tries to repair certain network faults. Whenever a station detects a serious problem with the network (such as a cable break), it sends a beacon frame, which defines a failure domain. This domain includes the station reporting the failure, its nearest active upstream neighbor (NAUN), and everything in between. Beaconing initiates a process called auto reconfiguration, where nodes within the failure domain automatically perform diagnostics in an attempt to reconfigure the network around the failed areas. Physically, the MSAU can accomplish this through electrical reconfiguration.

10) Security:

Authentication, Authorization, and Accounting (AAA), Terminal Access Controller Access Control System (TACACS), and RADIUS: general concepts, usage, comparisons

Firewalls: PIX, access lists, demilitarized zones (DMZ)

Encryption: public/private key, Data Encryption Standard (DES)

Radius – UDP and encryption

Tacacs – UDP and encryption

Tacacs+ - TCP and encryption

A company is connected to the Internet. What must they do to protect themselves? ACL, distribution list?

DES or encryption

Data Encryption Standard, standard cryptographic algorithm developed by the U.S. National Bureau of Standards

11) Multiservice:

Voice/Video: H.323, codecs, Signaling System 7 (SS7), Real-Time Transport Protocol (RTP), RTP Control Protocol (RTPCP), Quality of Service (QoS)

Erlang B – Voice traffic unit of measure

What is H323 – video conf gateway services

SS7

Signaling System 7. Standard CCS system used with BISDN and ISDN. Developed by Bellcore.

RTP

1. Routing Table Protocol. VINES routing protocol based on RIP. Distributes network topology information and aids VINES servers in finding neighboring clients, servers, and routers. Uses delay as a routing metric. See also SRTP.

2. Rapid Transport Protocol. Provides pacing and error recovery for APPN data as it crosses the APPN network. With RTP, error recovery and flow control are done end-to-end rather than at every node. RTP prevents congestion rather than reacts to it.

****3.** Real-Time Transport Protocol, one of the IPv6 protocols. RTP is designed to provide end-to-end network transport functions for applications transmitting real-time data, such as audio, video, or simulation data, over multicast or unicast network services. RTP provides services such as payload type identification, sequence numbering, timestamping, and delivery monitoring to real-time applications.

RTPCP

RTP Control Protocol, protocol that monitors the QOS of an IPv6 RTP connection and conveys information about the on-going session.

QOS

Quality Of Service, measure of performance for a transmission system that reflects its transmission quality and service availability.

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Lab#1

1-Day Format

Version 2.00

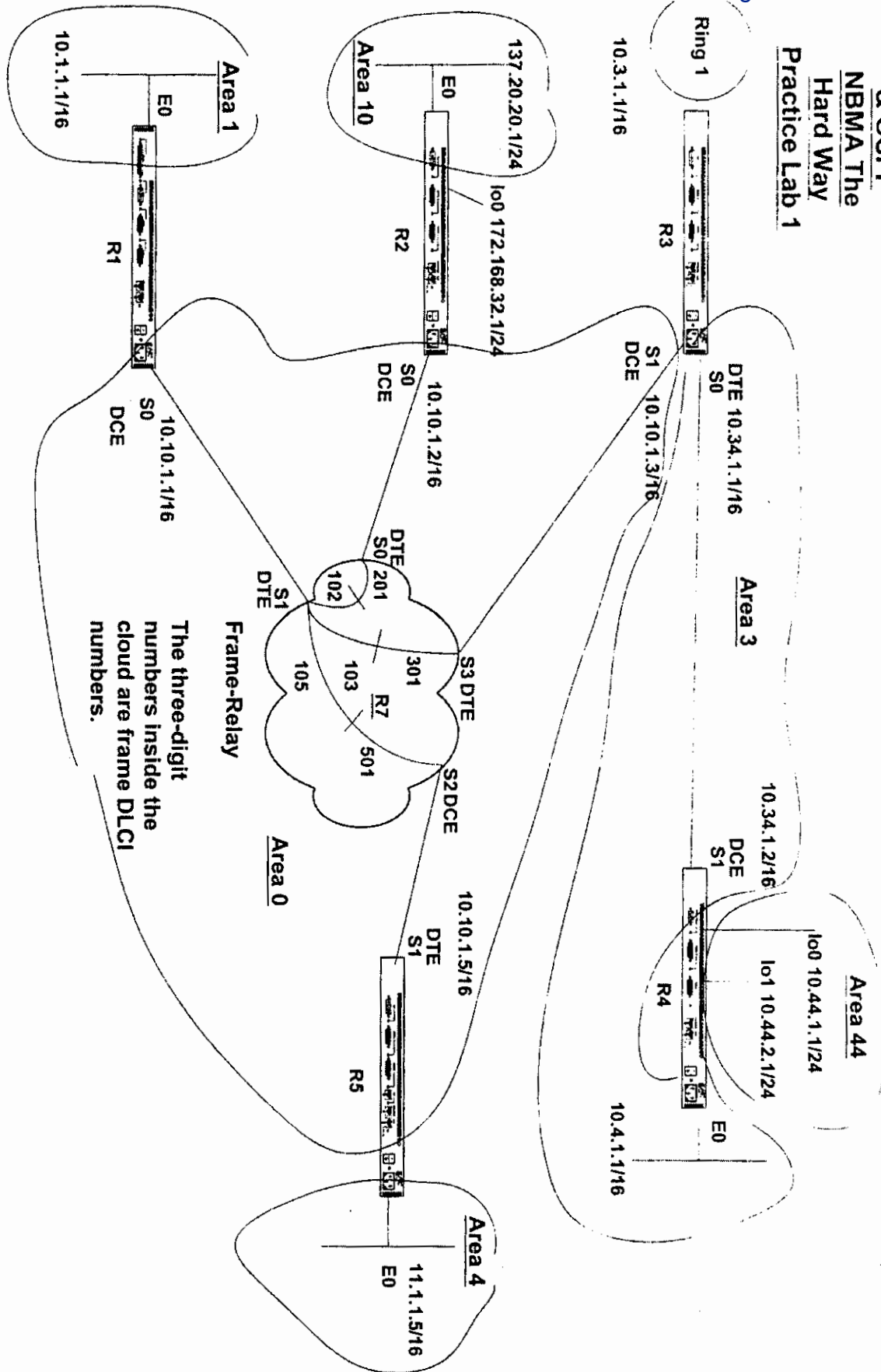
**Policy routing
Frame Relay
OSPF**

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Frame Relay & OSPF NBMA The Hard Way Practice Lab 1



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At the end of this lab verify connectivity to all ports. **You should be able to ping every interface from any router. (Don't worry about being able to ping a local frame-relay interface.)**

1. Initial Configuration

--- The frame-relay connections between routers R1, R2, R3, R5 will be multipoint

2. OSPF Configuration

- How are neighbor relationships created on NBMA networks?
- Check your IP routing tables.
- What is the next hop address for all of your routes?
- Policy routing is done per interface.
- Is OSPF area 44 connected to the backbone?
- Do we need to use policy routing?

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At the end of this lab verify connectivity to all ports. You should be able to ping every interface from any router. (Don't worry about being able to ping a local frame-relay interface. Please disregard this statement if you are asked to filter packets, routes or other specific tasks.)

1. Initial Configuration – 5 pts (30 minutes)

- a. Use the pre-configuration files to apply proper IP addresses to the router interfaces. Add IP addresses as needed as shown on the network diagram.
- b. Configure router R7 as a frame-relay switch. Refer to the diagram for interface connections to other routers connected to router R7.
- c. Connect routers R1, R2, R3, and R5 over the frame-relay cloud. Configure router R1's S0 interface as a sub-interface. Configure R2, R3, and R5 without using sub-interfaces. Use only one frame-relay PVC on routers R2, R3, and R5. The recommended DLCI numbers 102,201,103,301,105, and 501 are indicated on the lab diagram.
- d. Routers R1, R2, R3, and R5 should share network 10.10.X.X 255.255.0.0 on their frame-relay interfaces.
- e. Router R1 should have network 10.1.X.X with an 8-bit subnet mask on its Ethernet interface. (The mask should be 255.255.0.0)
- f. Make sure all the Ethernet interfaces are in their own broadcast domain if you are using an Ethernet switch for your Ethernet connections.

2. OSPF Configuration – 25 pts (2 hours 30 minutes)

- a. Configure OSPF area 0 on the frame-relay interfaces between R1, R2, R3, and R5.
- b. Configure router R1's interface Ethernet 0 for OSPF area 1.
- c. Configure router R2's interface Ethernet 0 for OSPF area 10.
- d. Configure router R3's interface serial 1 and all of router R4's interfaces for OSPF area 3.
- e. Configure router R5's interface Ethernet 0 for OSPF area 4.
- f. Create two loopback interfaces on R4 and put both of the associated subnets on these interfaces in OSPF area 44.
- g. Summarize the (2) loopback interfaces you just created on router R4 so they appear as one route to the rest of the OSPF routers in your network.
- h. Here is the tricky part. You can't use the **command ip ospf network XXXXX** anywhere in your router configurations.
- i. Redistribute the default route on router R2 as type-1 with a metric of 100. This route is already part of the initial configurations we provided for you.

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- j. Also, one of the problems in this lab can be solved with multiple frame map ip statements, but that is not the solution we want you to use. Solve the problem with routing, not layer 3 to layer 2 mapping via additional frame map statements !!!! (Yes, this is a tricky issue)

You have completed lab 1. Compare your configurations to the ones we provided. Often there is more than one to complete a task so your configurations may be different than ours. If your configurations are different than ours make sure you understand how to complete the lab with our configurations too.

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Lab#2

1-Day Format

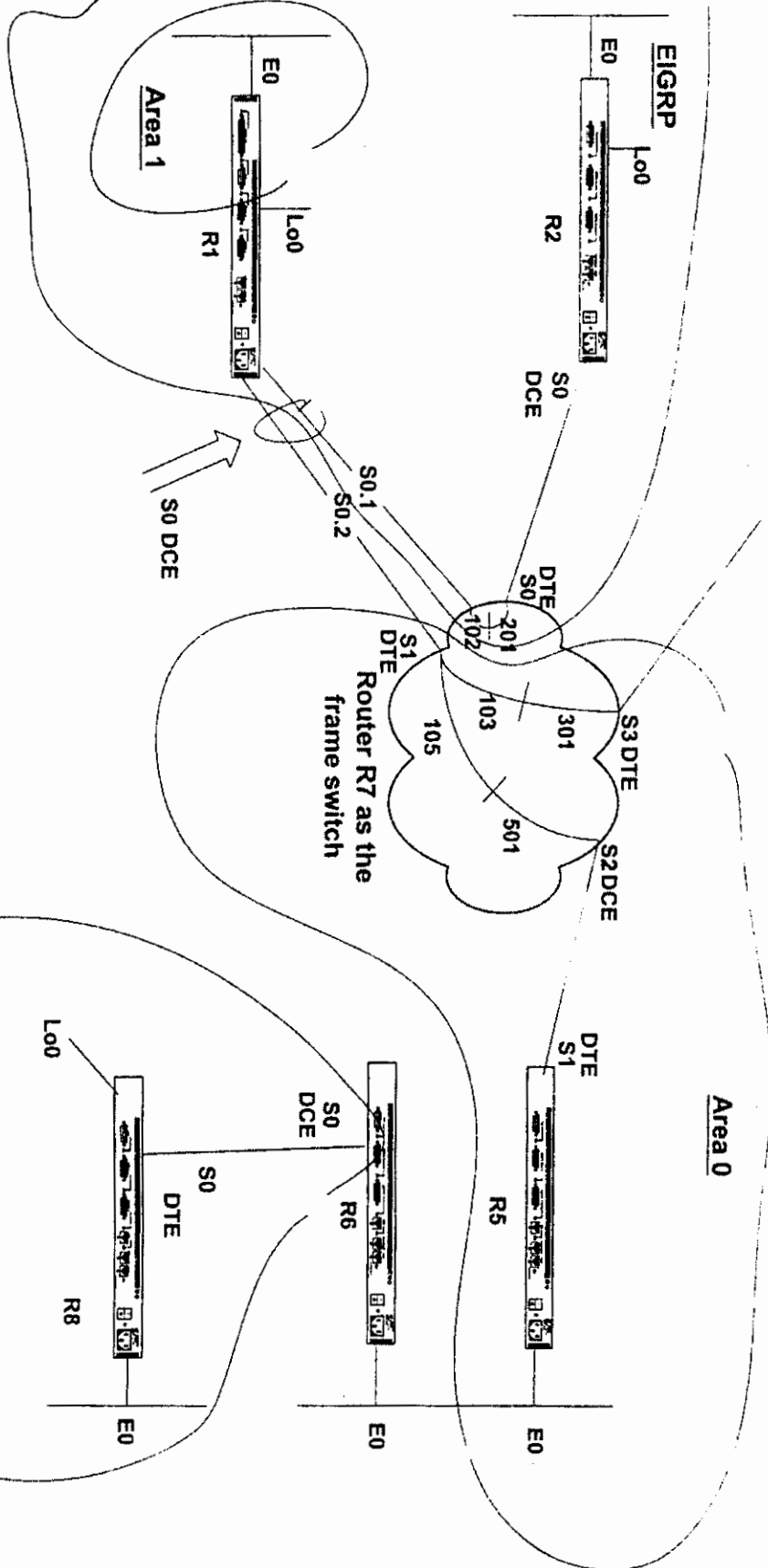
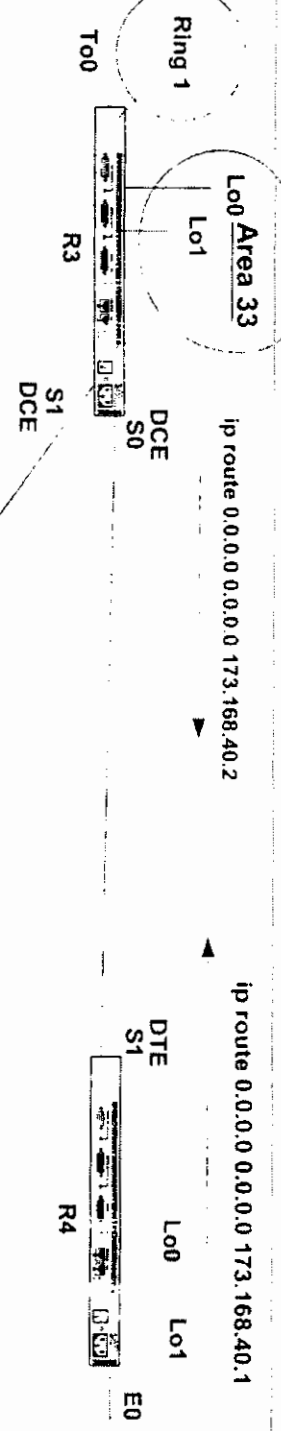
Version 2.00

**OSPF with summarization & default route
EIGRP for IP
BGP
Route redistribution
Frame Relay**

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Lab Two
OSPF & BGP
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Network Learning, Inc. R&S CCIE Practice Lab 2 Hints

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2. OSPF Configuration

- What is the administrative distance for EIGRP? How does it compare to OSPF?
- Split horizon is disabled on a frame relay encapsulated interface if no sub-interfaces are used.
- You may need to redistribute a static route into OSPF.
- Don't forget metrics during redistribution.
- Split horizon is enabled on an HDLC encapsulated serial interface.

3. BGP Configuration

- What is the update-source for the R3 to R4 IBGP connection on R3?
- Are all the routers in BGP autonomous system 2 (IBGP peers) fully meshed?
- How does BGP handle the next hop attribute on non-broadcast media access?
- What rules apply when redistributing OSPF into BGP?
- Did you put a static route into OSPF? If so, do you want this route in BGP?
- Are you familiar with the clear ip bgp * command?
- Are you familiar with the command show ip bgp neighbor?
- The BGP synchronization rule states that if an AS provides transit service to another AS, BGP should not advertise a route until all of the routers within the AS have learned about the route via an IGP.
- What source IP address does a router use when it sends out a ping?
- Be careful of routing loops in this lab.

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Network Learning, Inc. R&S CCIE Practice Lab 2

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At the end of this lab verify connectivity to all ports. **You should be able to ping every interface from any router. (Don't worry about being able to ping a local frame-relay interface. Please disregard this statement if you are asked to filter packets, routes or other specific tasks.)**

1. Initial Configuration – 5 pts (30 mins)

- a. Use the pre-configuration files to apply proper IP addresses to the router interfaces. Add IP addresses as needed as shown on the network diagram. You may have to add additional IP addresses to complete some tasks.
- b. Connect routers R1, R2, R3, and R5 over the frame-relay cloud. Configure router R1 using sub-interfaces. Configure routers R2, R3, and R5 without using sub-interfaces.
- c. Use only one frame-relay PVC on routers R2, R3, and R5. The recommended DLCI numbers 102,201,103,301,105, and 501 for the frame-relay PVC's are indicated on the network diagram.
- d. Routers R1, R3, and R5 should share network 10.10.X.X 255.255.0.0 on their frame-relay interfaces.
- e. Routers R1 and R2 should share network 10.20.X.X 255.255.0.0 on their frame-relay interfaces.
- f. Router R1 should have network 10.1.X.X with an 8-bit subnet mask on its Ethernet interface (The mask should be 255.255.0.0)
- g. Router R2 should have network 137.20.20.0 with a 24-bit mask on its Ethernet interface.
- h. Router R3 should have network 10.3.X.X with an 8-bit subnet mask on its token-ring interface (The mask should be 255.255.0.0)

2. OSPF Configuration – 30 pts (2 hours 30 minutes)

- a. Configure OSPF area 0 on the frame-relay interfaces between routers R1, R3, and router R5.
- b. Place router R1's Ethernet in OSPF area 1. Place router R5's interface E0 in OSPF area 0.
- c. Setup a default static route (default gateway) from R3 to R4. Redistribute this default static route into OSPF with a metric-type of 1 and a metric of 500.
- d. Configure router R3's serial one interface as 173.168.40.1/24 and router R4's serial 0 interface as 172.168.40.2/24.
- e. Configure router R4's Ethernet 0 interface as 200.100.100.1 /24
- f. Configure a default gateway on router R4 to route all packets for which it has no routes to router R3.

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- g. Configure two loopback interfaces on router R3 with networks that could have at most 254 hosts and put them both in the same OSPF area, but different from OSPF area 0. Summarize this route into OSPF so that the two subnets appear as one route.
- h. Configure router R2 for EIGRP and put all interfaces in the routing process.
- i. Configure router R1 with EIGRP and redistribute with OSPF. Set the metric type to type-1 when you redistribute from EIGRP to OSPF. Also, redistribute OSPF into EIGRP.
- j. Configure router R1 so that it only listens to EIGRP updates on Ethernet 0 and interface serial S0.2
- k. Configure router R6 for OSPF with a different process ID than was used thus far. Do not configure R6's Ethernet E0 for OSPF.
- l. Configure router R8 to be in the same OSPF area as router R6. Put router R8's interface E0 & Lo0 into the OSPF routing process. Configure router R6 so that its S1 interface speed is correctly reflected in the OSPF metrics without using the "ip ospf cost xxx" command.
- m. Configure OSPF message-digest authentication between routers R6 & R8.
- n. Change the OSPF hello interval between routers R6 & R8 to 45 seconds.
- o. Configure router R8 using the "ip ospf cost" command such that the speed of the link for interface S0 is correctly reflected in the OSPF metrics.
- p. Change the OSPF transmit interval delay to 10 seconds between routers R6 & R8.
- q. Add a default route to router R2 that points to 137.20.20.2. Configure one static route on router R2 so that full connectivity to R4's interface E0 is available. You will notice that the default gateway of router R2 has a lower administrative cost than the one learned via router R1. As a result, the other default route never makes it in the routing table for router R2.
- r. You will notice that router R2 can't ping the serial interfaces between routers R3 & R4. Fix this problem by only making changes to router R3 without static routes.

3. BGP Configuration – 15 pts (1 hour)

- a. Configure router R4 in BGP autonomous system 1.
- b. Create a static route to null0 router R4 and redistribute into BGP.
- c. Create a loopback interface on R4 and add its network to BGP.
- d. When adding the first loopback to BGP use a class A address with a 24-bit mask. The network that was added to BGP from the first loopback address should appear in the routing table of other routers as "B 44.1.1.0"
- e. Create another loopback on router R4 with a class A address and put this network into RIP and redistribute RIP into BGP.
- f. Configure router R3 in BGP autonomous system 1 and use interface loopback 0 as the update source.
- g. Configure routers R1, R2, and R5 in BGP autonomous system 2. Only use one neighbor X.X.X.X remote-as 2 command on routers R2, R3, & R5 for autonomous system 2.
- h. Place routers R6 and R8 in BGP autonomous system 3.
- i. Configure BGP authentication between routers R6 & R8.
- j. Configure a loopback interface on router R8 and enable RIP for this network. Redistribute this RIP network into OSPF.
- k. Redistribute the OSPF routing process that contains routers R6 and R8 into BGP.
- l. You are not allowed to add any static routes to router R8 during this exercise.

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- m. Configure router R6 such that all BGP routes learned from router R5 have a local preference of 300.
- n. Filter on router R5 such that the BGP route to null0 defined on router R4 isn't seen on routers R6 & R8.
- o. Hint the object of this BGP section is to provide end-to-end connectivity between all routers and interfaces. In this exercise you are not allowed to configure IGP or two-way static route connectivity between routers R5 & R6. BGP should be providing the necessary routing information. You are allowed to setup a default route on router R6 to point to router R5.

Now that you have completed lab 2 check, the routing tables on all routers. Do they make sense? Ping all interfaces from all routers. Can you ping everywhere? Do the appropriate routers see the static route to null0 on R4 via BGP? Go to every router and ping every interface. If you can't ping everything you are not done yet.

You have completed lab 2. Compare your configurations to the ones we provided. Often there is more than one to complete a task so your configurations may be different than ours. If your configurations are different than ours make sure you understand how to complete the lab with our configurations too.

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Lab#2

1-Day Format

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**OSPF with summarization & default route
EIGRP for IP
BGP
Route redistribution
Frame Relay**

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Lab#3

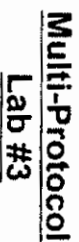
1-Day Format

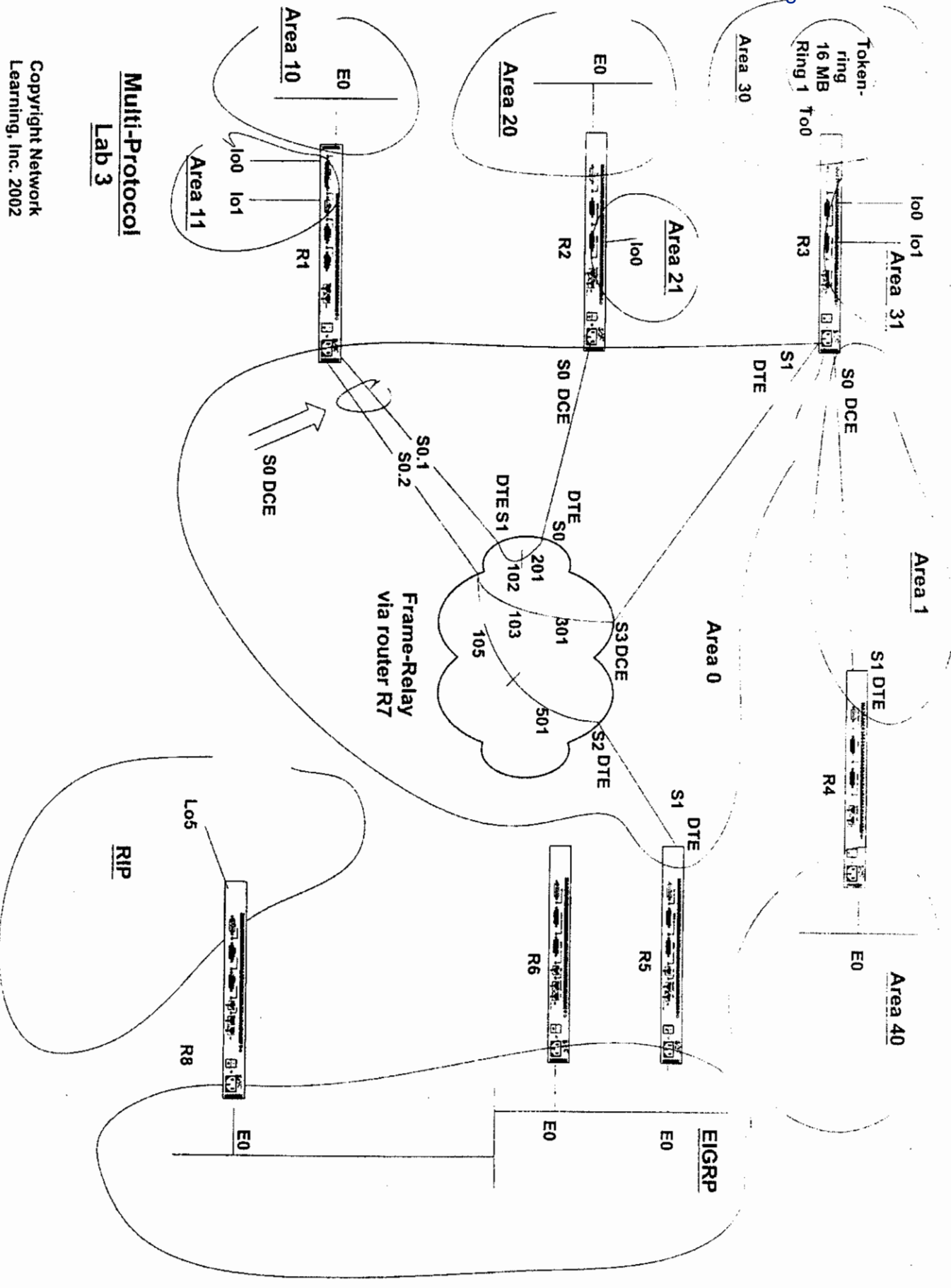
Version 2.00

**OSPF with summarization
EIGRP for IP & IPX
IPX with filtering & tunneling
NTP
Traffic shaping
SAP filtering
DLSW
Traffic prioritization.
BGP
VLSM
CIDR
Netbios filtering
Route filtering
Tricky access-lists
Tunneling
Route redistribution
Frame Relay
IP filtering
IPX type20-propagation**

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Multi-Protocol

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2. OSPF & Other IP Routing Configuration

- The frame-relay connection between routers R1, R3, R5 will be multi-point
- Is OSPF area 40 connected to area 0?

4. IPX Configuration

- Do you have split horizon issues in your IPX network?
- Do you have to tunnel IPX to accomplish to task?

6. BGP Configuration

- Are all of your IBGP routers fully meshed?

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Network Learning, Inc. R&S CCIE Practice Lab 3

Version 2.00 1-Day Version

At the end of this lab verify connectivity to all ports. You should be able to ping every interface from any router. (Don't worry about being able to ping a local frame-relay interface. Please disregard this statement if you are asked to filter packets, routes or other specific tasks.)

1. Initial Configuration – 5 pts (30 mins)

- a. Use the pre-configuration files to apply proper IP addresses to the router interfaces. Add IP addresses as needed as shown on the network diagram. You may have to add additional IP addresses to complete some tasks.
- b. Configure lab 3 network using network 137.20.X.X.
- c. Create a loopback interface on router R2 with 172.168.32.1/24.
- d. Connect routers R1, R2, R3, and R5 over frame-relay cloud.
- e. Configure router R1 using sub-interfaces.
- f. Configure router R2 without using sub-interfaces or frame-relay map commands.
- g. Put routers R1 & R2 frame-relay interfaces on one subnet and routers R1, R3, and R5 on a different subnet.

2. OSPF & Other IP Routing Configuration – 35 pts (2 hours)

- a. Configure OSPF with the frame-relay cloud in OSPF area 0.
- b. Configure the R3-R4 serial connection to be in area 1.
- c. Set the ring-speed on router R3 to 16Mbps.
- d. Configure the loopback interface on router R2 in a different OSPF area.
- e. Configure the LAN interfaces on routers R1, R2, and R3 to be in different OSPF areas.
- f. Configure two loopbacks on router R3 using subnets that will contain at most 30 host IP addresses.
- g. Configure two loopback interfaces on router R1 using subnets that will contain at most 14 host IP addresses.
- h. Summarize the two loopback interfaces on routers R1 and R3 such that router R2 only sees one route from each.
- i. Configure the Ethernet interface E0 on router R4 to be in OSPF area 40.
- j. Configure the R5, R6, and R8 Ethernet 0 interfaces to use EIGRP.
- k. Configure R8's interface loop5 as 192.168.100.1/24 and add it to RIP.
- l. Redistribute routes between all protocols such that router R1 can ping any interface.

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- m. Configure 2 loopbacks interfaces on router R8 with 10.1.1.1/24 & 10.1.2.1/24. Add these to RIP and redistribute RIP to EIGRP. Summarize such that all routers only see one route to the loopback interfaces. Test connectivity to loopback interfaces via ping.
- n. Filter such that router R6 can ping the loopbacks on router R1, but not the Ethernet interface on router R1. The route for the Ethernet on router R1 should still be visible and all other traffic such as telnet should still pass unfiltered.
- o. Filter on router R5 such that routers R1, R2, R3, and R4, don't see the route to router R8's interface loopback 5.
- p. Create three loopback interfaces on router R8 and use 160.10.10.1/24 for loopback 2, 161.10.10.1/24 for loopback 3, and 170.10.10.1 for loopback 4. Now summarize the three loopback networks into one route. When done router R1 should see only one route for these three loopback interfaces and should be able to ping all three of them. Hint, the route may not look like what you think.

3. NTP & Access-list & Other Tasks 15 pts (30 mins)

- a. Configure NTP between routers R2 & R3. Make R2 the time source. Set the correct time and date on router R2. Set the time-zone on routers R2 & R3. Verify that router R3 has synced with router R2 via NTP.
- b. Configure queuing on router R3's S0 interface such that telnet, ip, ipx, and everything else use 25% of the bandwidth each. Configure the queuing such that none of the traffic defined at 25% above uses more than 1000 bytes per time slice. You are allowed to exceed 1000 bytes per time slice only if there is part of a remaining individual packet that needs to be emptied from the queue.
- c. Configure the frame-relay interface on router R2's interface S0 such that IP is discard eligible on the frame.
- d. Create the following 6 static routes on router R6; using the Cisco IOS command `ip route 192.168.X.0 255.255.255.0 null 0`. Use the number 1,2,3,4,5, and 6 for the variable X. Redistribute the static routes such that they are seen by all the other routers. Now filter on router R5 using any method that uses an access list so that only the even routes (i.e. X=2,4, and 6) are seen past router R5 towards the OSPF network. Your access-list can only have two lines in it, not seven for this exercise. All the 192.168.X.0 routes must still be seen in router R5's routing table.

4. IPX Configuration – 20 pts (1 hour)

- a. Configure all interface (including loopbacks) for IPX.
- b. Configure IPX EIGRP on the NBMA frame-relay network.
- c. Configure IPX RIP/SAP everywhere else.
- d. Configure two static SAPs on router R3. Filter on router R5 such that routers R6 and R8 only see one of the SAPs.
- e. Disable IPX on the between routers R3 & R4 All routes should still be seen by all routers running IPX.
- f. Change the frequency of the RIP updates across the R3-R4 serial connection to once every 2 minutes.